

REMARKS

Pending Claims

Claims 1, 3 and 4 remain pending in this application. Claim 1 has been amended. Claims 2 and 5 previously have been canceled without prejudice or disclaimer. No new matter has been added.

Taiwan 412629

The Examiner stated that the Abstract provided for Taiwan 412629 did not provide enough information and requested a more complete translation. Applicants' attorneys have been advised that an English translation is being provided and will file the English translation as soon as it is received

Form of the Claims

The Examiner has stated that the claims "continue to" claim many features functionally without supporting "means for"...recitations. Applicants' have amended the claims in the manner in which it is believed claims the features more positively, including a "means for..." recitation.

Claim Rejections Under 35 U.S.C. §103

Claims 1, 3 and 4 stand rejected under 35 U.S.C. §103(a) as being unpatentable over JP 2003-314936, in view of Takeda, U.S. Patent No. 6,414,843 (Fig. 5), Cheng U.S.

Patent No. 5,197,858 and, optionally, Algrain, U.S. Patent No. 6,352,055 (Figs. 1 and 2).

For the reasons set forth hereafter, it is submitted that the amended claims 1, 3 and 4 are patentable.

Patentability of the Claims

Claim 1 has been amended to define further details of Applicants' invention. As now defined in claim 1, the present invention is a cooling system for an electronic equipment which cools a heat generating portion by a cooling liquid (antifreeze liquid) circulated by a pump and which cools the cooling liquid by a fan. A temperature sensor is provided that detects temperature of the heat generating portion and means are provided for storing predetermined information that prescribes a relationship between the temperature of the heat generating portion and the driving voltages of the pump and the fan. The cooling system further includes a control device configured to determine and control voltages of the pump and the fan on the basis of temperature detected by the temperature sensor and the storage information wherein the storage information regulates the driving voltages of the pump and the fan so as to make the driving voltage of the pump high and increase a cooling capacity when the temperature of the heat generating portion increases and further to make the driving voltage of the fan high and increase a cooling capacity when the temperature of the heat generating portion increases to increase an amount of heat generation. The control device is configured to operate the pump and fan at a predetermined voltage when the temperature detected by the temperature sensor does not exceed a first temperature and the control device, using the

storage information is further configured to maintain the driving voltage of the fan unchanged and to increase the driving voltage of the pump to increase a flow rate of the liquid cooling medium and to increase a cooling capacity of the cooling system when the temperature detected by the temperature sensor exceeds the first temperature. The control device is also configured to increase the driving voltage of the fan to further increase the flow rate of the fan and to further increase the cooling capacity of the cooling system when the temperature detected by the temperature sensor exceeds a second temperature higher than the first temperature.

The pump and fan are operated with a predetermined voltage when a load on the electronic equipment is small. When the electronic equipment is under a high load which increases an amount of heat generation, the pump voltage is first raised to increase the cooling capacity. As the amount of heat generation increases to increase the temperature of the heat generating portion, the fan voltage is raised to increase the cooling capacity. By first raising the pump voltage, the raising of the driving voltage of the fan to increase the rotational speed of the fan may be delayed, thus also preventing the fan from making more noise.

With the present invention, whereby a liquid cooling system transfers heat by the heat capacity of the cooling liquid to perform cooling, the temperature dependency of the viscosity of the cooling liquid is noted, so that the cooling capability is secured by setting the temperature of the cooling liquid high to improve a performance of a flow rate.

In contrast, the main reference relied upon, JP-A-2003-314936, discloses a cooling system which uses a "latent heat thermal storage medium" as a cooling liquid.

Fig. 4 of the '936 reference shows the heat medium pump PM: ON and the blowing fan FN: OFF between the first temperature T_{s1} and the second temperature T_{s2} of the CPU temperature T_c , and the heat medium pump PM: ON and the blowing fan FN: ON when the CPU temperature T_c becomes equal to or greater than the second temperature T_{s2} . The '936 reference has the appearance of disclosing the pump operated prior to the fan. However, the heat medium pump PM: ON and the blowing fan FN: OFF settings are used in order to make the temperature distribution of the "latent heat thermal storage medium" even and effectively use the thermal capacity (see paragraph [0068]). This is different.

Thus, the '936 reference discloses the specific control operation of the cooling apparatus using the "latent heat thermal storage medium" as a cooling liquid, so that this control operation is different from that of taking the viscosity of the cooling liquid into consideration as in the present invention.

The Examiner states that "all the limitations of claims are met by the prior art". As mentioned above in detail, however, the main cited reference of JP-A-2003-314936 discloses the art of a cooling system using a latent heat, thermal storage medium as a cooling liquid, in which, when the CPU temperature T_c is lower than a first temperature T_{s1} , the heat medium pump PM: OFF, the blowing fan FN: OFF are set (see Figure 2, the paragraph 0039.).

On the other hand, the present invention relates to the art of cooling as performed by transferring heat with the heat capacity of a cooling liquid, in which, when the temperature detected by the temperature sensor does not exceed the first temperature (corresponding to the case that the CPU temperature T_c is lower than the first

temperature Ts1), the pump and fax are operated at a predetermined temperature.

This is made more definite by the present amendment.

The Takeda '843, Cheng '858 and Algrain '055 patents were only cited as secondary references and do not disclose Applicants' invention as now claimed.

In view of the foregoing, it is submitted that the claims now patentably distinguish over the cited references taken either alone or in combination.

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ASA-1172

CONCLUSION

In view of the foregoing amendments and remarks, Applicants contend that the above-identified application is now in condition for allowance. Accordingly, reconsideration and reexamination are respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of Mattingly, Stanger, Malur & Brundidge, P.C., Deposit Account No. 50-1417 (referencing attorney docket no. ASA-1172).

Respectfully submitted,

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